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CLAIMS 1-45 CANCELED

46. A method for use in forming a capacitor, the method comprising:

providing a subsrate assembly in a reaction chamber, the substrate assembly including at least one surface; and

forming an electrode on the at least one surface of the substrate assembly, wherein forming the electrode comprises:

providing a ruthenium-containing precursor into the reaction chamber, and

depositing a rough ruthenium layer on the surface of the substrate assembly from the ruthenium precursor at a rate of about 100 Å/minute to about 500 Å/minute.

47. The method of claim 46, wherein the substrate assembly includes an opening defined therein, wherein the opening is defined by a bottom surface of the substrate assembly and at least one side wall extending therefrom.

48. The method of claim 46, wherein providing a ruthenium-containing precursor into the reaction chamber includes providing a carrier gas at a flow rate of about 100 sccm to about 500 sccm through a ruthenium-containing precursor maintained at a temperature of about 15 °C to about 100 °C into the reaction chamber to deposit the rough ruthenium layer on the surface of the substrate assembly.

49. The method of claim 48, wherein the method further includes maintaining the substrate assembly surface at a temperature in a range of about 100°C to about 400°C and maintaining the pressure of the reaction chamber in a range of about 0.4 torr to about 10 torr.

50. The method of claim 48, wherein the method further includes annealing the rough ruthenium layer at a temperature in a range of about 300°C to about 900°C for a time period in a range of about 30 seconds to about 30 minutes.

51. The method of claim 50, wherein annealing the rough ruthenium layer further includes annealing the rough ruthenium layer at a pressure in a range of about 0.1 millitorr to about 5 atmospheres in a gas atmosphere subjected to a glow discharge created by applying an electromagnetic field across the gas mixture.

52. The method of claim 46, wherein providing the substrate assembly surface includes providing non-rough ruthenium, the rough layer of ruthenium formed on the non-rough ruthenium.

53. The method of claim 46, wherein providing the substrate assembly surface includes providing non-rough ruthenium oxide, the rough layer of ruthenium formed on the non-rough ruthenium oxide.

54. A method for use in forming a capacitor, the method comprising:

providing a substrate assembly in a reaction chamber, the substrate assembly including at least one surface; and

forming an electrode on the at least one surface of the substrate assembly, the forming of the electrode comprising:

providing a ruthenium-containing precursor into the reaction chamber,

providing an oxygen-containing precursor into the reaction chamber, and

depositing a rough ruthenium oxide layer on the surface of the substrate assembly at a rate of about 100 Å/minute to about 1200 Å/minute.

55. The method of claim 54, wherein the substrate assembly includes an opening defined therein, wherein the opening is defined by a bottom surface of the substrate assembly and at least one side wall extending therefrom.

56. The method of claim 54, wherein providing a ruthenium-containing precursor into the reaction chamber includes providing a carrier gas at a flow rate of about 100 sccm to about 500 sccm through the ruthenium-containing precursor maintained at a temperature of about 15 °C to about 100 °C into the reaction chamber, and further wherein providing the oxygen-containing precursor into the reaction chamber includes providing an oxygen-containing precursor into the reaction chamber at a flow rate of about 100 sccm to about 2000 sccm.

57. The method of claim 56, wherein the method further includes maintaining the substrate assembly surface at a temperature in a range of about 100°C to about 400°C and maintaining the pressure of the reaction chamber in a range of about 0.4 torr to about 100 torr.

58. The method of claim 56, wherein the method further includes annealing the rough ruthenium oxide layer at a temperature in a range of about 300°C to about 900°C for a time period in a range of about 30 seconds to about 30 minutes.

59. The method of claim 58, wherein annealing the rough ruthenium oxide layer further includes annealing the rough ruthenium layer at a pressure in a range of about 0.1 millitorr to about 5 atmospheres in a gas atmosphere subjected to a glow discharge created by applying an electromagnetic field across the gas mixture.

60. The method of claim 54, wherein providing the substrate assembly surface includes providing non-rough ruthenium, the rough layer of ruthenium formed on the non-rough ruthenium.

61. A capacitor structure comprising:

a first electrode formed of at least a rough ruthenium layer, wherein a surface of the rough ruthenium layer has a surface area greater than about 1.2 times a surface area of a completely smooth surface having a substantially identical shape as the surface of the rough ruthenium layer;

a dielectric layer formed on at least a portion of the first electrode; and

a second conductive layer formed on the dielectric layer.

62. The capacitor structure of claim 61, wherein the surface of the rough ruthenium layer has a surface area greater than about 1.5 times the surface area of the completely smooth surface having the substantially identical shape as the surface of the rough ruthenium layer

63. The capacitor structure of claim 61, wherein the first electrode further comprises non-rough ruthenium upon which the layer of rough ruthenium is formed.

64. The capacitor structure of claim 61, wherein the first electrode further comprises non-rough ruthenium oxide upon which the layer of rough ruthenium is formed.

65. A capacitor structure comprising:

a first electrode formed of at least a rough ruthenium oxide layer, wherein a surface of the rough ruthenium oxide layer has a surface area greater than about 1.2 times a surface area of a completely smooth surface having a substantially identical shape as the surface of the rough ruthenium oxide layer;

a dielectric layer formed on at least a portion of the first electrode; and

a second conductive layer formed on the dielectric layer.

66. The capacitor structure of claim 65, wherein the surface of the rough ruthenium layer has a surface area greater than about 1.5 times the surface area of the completely smooth surface having the substantially identical shape as the surface of the rough ruthenium layer.

67. The capacitor structure of claim 65, wherein the first electrode further comprises non-rough ruthenium upon which the layer of rough ruthenium oxide is formed.

68. The capacitor structure of claim 65, wherein the first electrode further comprises non-rough ruthenium oxide upon which the layer of rough ruthenium oxide is formed.